Draft Surface Storage Option Technical Memorandum

Dinkey Creek Reservoir

Prepared for

U.S. Bureau of Reclamation
Mid Pacific Region

By

MWH
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March 2003

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TECHNICAL MEMORANDUM

DINKEY CREEK RESERVOIR

UPPER SAN JOAQUIN RIVER BASIN STORAGE INVESTIGATION

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ACKNOWLEDGMENTS

The preparers acknowledge the valuable assistance provided by Mr. Roy Proffitt and Mr. Frank Fonseca of the Pine Flat U. S. Army Corps of Engineers (COE) office; Mr. Jim Richards of the KRCD office at Pine Flat Dam; and Ms. Mary Moore at the COE library in Sacramento.

EXECUTIVE SUMMARY

An appraisal-level study of a potential dam and reservoir on Dinkey Creek to facilitate long-tem water storage was completed as part of the Upper San Joaquin River Basin Storage Investigation (Investigation). The Investigation is being completed by the U.S. Bureau of Reclamation Mid-Pacific Region, in cooperation with the California Department of Water Resources, consistent with recommendations in the CALFED Bay Delta Program Record of Decision, August 2000.

Dinkey Creek Dam would be a new structure constructed in the Sierra Nevada on Dinkey Creek, a tributary to the North Fork of the Kings River, just downstream of Dinkey Meadow. It would be a zoned rockfill dam 340 feet in height. The dam would create a reservoir with a storage capacity of 90,000 acre-feet at a gross pool elevation of 5,686 ft above mean sea level. As originally conceived by Kings River Conservation District (KRCD), the project would be capable of generating up to 89 mW of hydroelectric energy by developing the 4,400-foot of head between Dinkey Meadow and Dinkey Creek's confluence with the North Fork of the Kings River.

Water stored in Dinkey Creek Reservoir would be later released to Dinkey Creek, which would then contribute to flow in the North Fork of the Kings River. Releases from Dinkey Creek Reservoir would be exchanged for water diverted from Millerton Lake or offset Millerton releases to the San Joaquin River.

Construction costs for the Dinkey Creek hydropower project and all appurtenant facilities is estimated at $423 million. By subtracting costs associated with power generation, the first cost of a storage-only project is estimated at $122 million.

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CHAPTER 1. INTRODUCTION

The U.S. Bureau of Reclamation (Reclamation), in cooperation with the California Department of Water Resources (DWR), is completing the Upper San Joaquin River Basin Storage Investigation (Investigation) consistent with the CALFED Bay Delta Program Record of Decision (ROD), August 2000. The Investigation will consider opportunities to develop water supplies to contribute to water quality improvements in and restoration of the San Joaquin River and to enhance conjunctive management and exchanges to provide high quality water to urban areas. The ROD indicated that the Investigation should consider enlargement of Friant Dam or development of an equivalent storage program to meet Investigation objectives.

The Investigation identified several potential surface storage sites to be initially considered through appraisal-level studies of engineering and environmental issues. This Technical Memorandum presents findings from an appraisal-level review of the potential Dinkey Creek Dam and Reservoir.

PROJECT DESCRIPTION

The proposed Dinkey Creek Dam would be located in Fresno County, near Shaver Lake, about 40 miles northeast of Fresno. The damsite is located on Dinkey Creek, about 11 miles above its confluence with the North Fork of the Kings River at Balch Camp. The project location is shown in Figure 1-1. A map of the Dinkey Creek site and vicinity is shown in Figure 1-2.

The dam would create a reservoir with a capacity of 90,000 acre-feet. The primarily hydroelectric project would develop a 4,400-foot head between Dinkey Creek Meadow and its confluence with the North Fork. The average annual energy production of the project has been estimated at 272 gigawatt hours (IECO, 1974).

Water stored in Dinkey Creek Reservoir would be released further downstream to Dinkey Creek, which would then contribute to flow in the North Fork of the Kings River. Releases from Dinkey Creek Reservoir would be exchanged for water diverted from Millerton Lake or offset Millerton releases to the San Joaquin River.

EXISTING FACILITIES

No water storage facility presently exists at the site. There is a gaging station within the potential reservoir area.

SUMMARY OF PREVIOUS INVESTIGATIONS

In 1974, International Engineering Company, Inc. (IECO) prepared a Master Plan of the Kings River Service Area on behalf of the Kings River Conservation District (KRCD). The purpose of the Master Plan was to recommend a course of action that would: 1) provide a balanced water supply; 2) minimize flood damage; and 3) conserve and develop water and power resources. One of the alternatives evaluated consisted of the potential development of Dinkey Creek.

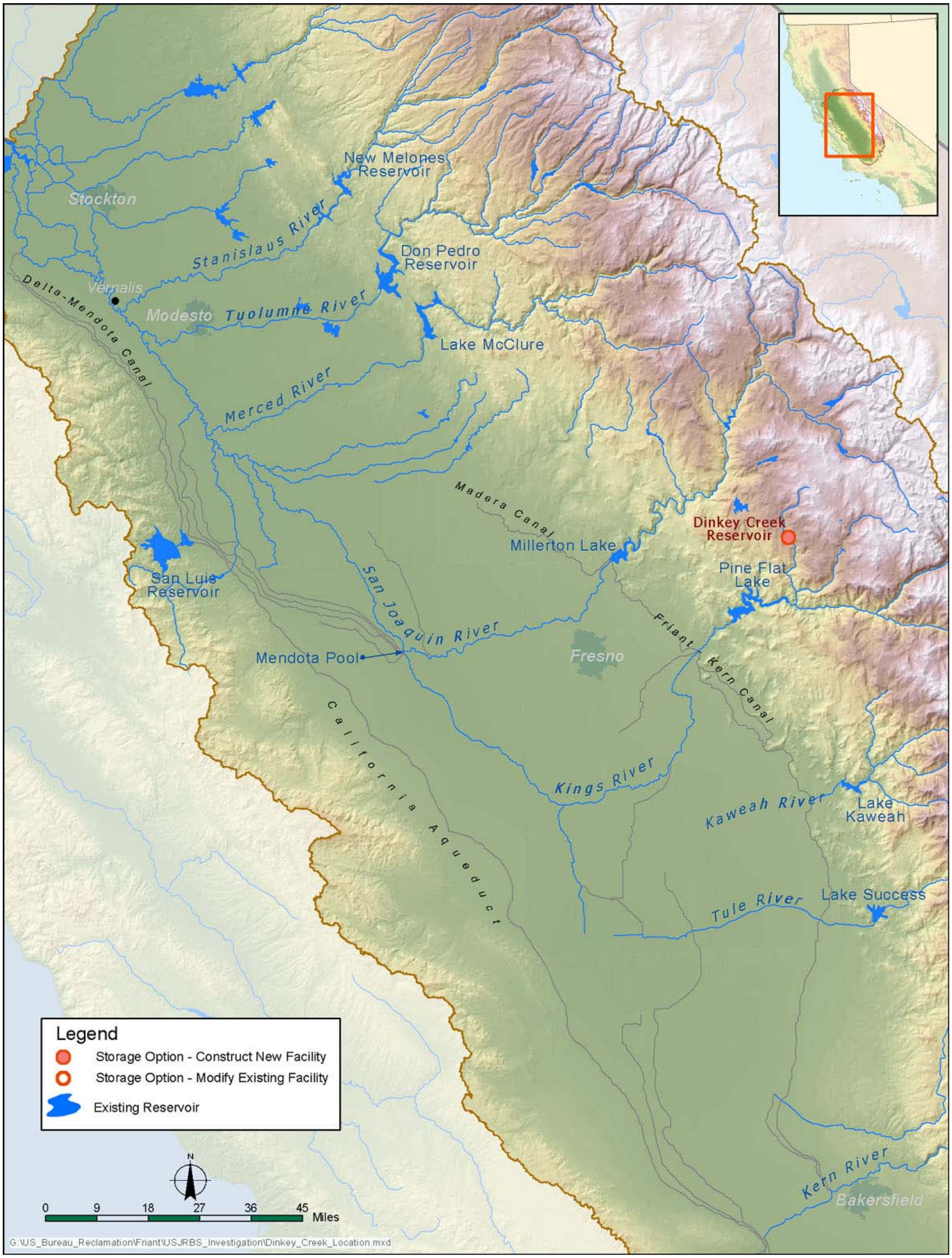

FIGURE 1-1. PROJECT LOCATION MAP

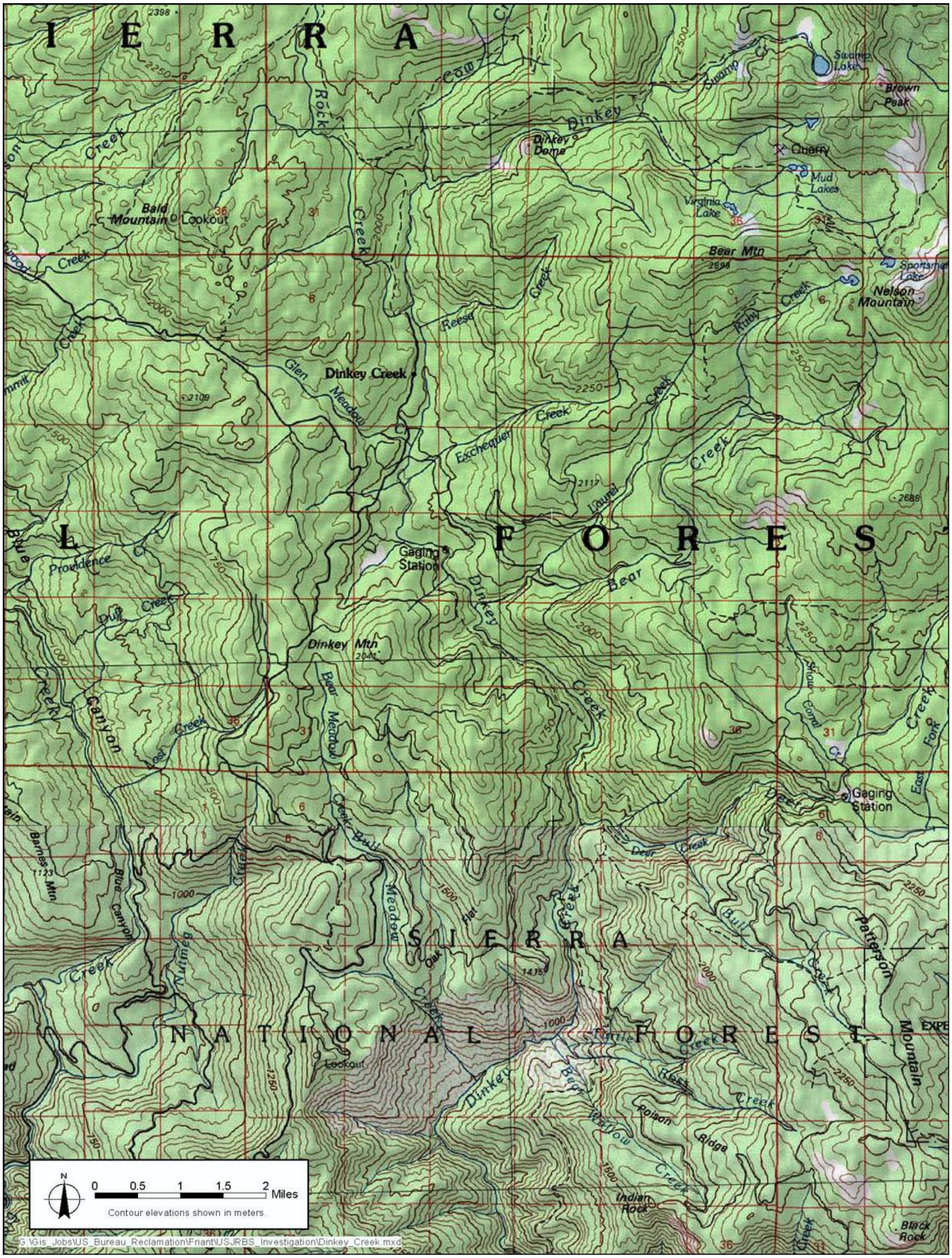

FIGURE 1-2. DINKEY CREEK AND VICINITY

The report concluded that the KRCD service area was deficient in water, and that unless additional water supplies were obtained, groundwater would be overdrafted to the point where a large segment of the agricultural service area would ultimately have to revert to dry farming. The IECO report concluded that a staged development of the recommended alternatives be pursued. Dinkey Creek Dam and Reservoir was found to be economically feasible and was retained as an alternative.

PROPOSED IMPROVEMENTS

The 1974 KRCD Master Plan for the Kings River Service Area recommended a 340-foot high rockfill dam, a diversion dam, two power plants, tunnels, access roads, and other works.

The upper structure, Dinkey Storage Dam would create a reservoir with a capacity of 90,000 acre-feet. The crest of the upper dam would be approximately 20 feet wide and 1,600 feet long at an elevation 5,700 feet above mean seal level (elevation 5,700). The gross pool elevation would be at elevation 5,686.

The spillway would be located on the right abutment and would be approximately 70 feet wide, designed to pass a maximum discharge of 13,000 cubic feet per second (cfs). It would consist of a short excavated approach channel, an ungated crest section, a concrete-lined chute and a discharge bucket that would direct the water a safe distance away from the spillway chute.

An intake structure at the main dam would lead to an unlined, 17,000-foot long, 10-foot diameter tunnel to a surge tank excavated in bedrock. The concrete lined surge tank would have an inside diameter of 21.5 feet and height of 263 feet. A second tunnel, 8 feet in diameter and steel lined, would lead for about 2000 ft from the surge tank to a 6-foot diameter steel penstock, 2000 ft in length, connecting to Power Plant No. 1 (see Figure 1-3).

Power Plant No. 1, a single unit, 26 mW plant, would discharge back to Dinkey Creek about four miles below the main upper dam. Dinkey Diversion Dam would then recapture the discharge and create 5 acre-feet of additional storage. The diversion dam, a 30-foot-high concrete structure, would divert the discharge from Power Plant No. 1 into another tunnel, which would extend to Power Plant No. 2, located near Balch Camp at the North Fork of the Kings River. The dam diversion capacity would be more than 350 cfs. Intervening flow from the drainage area between the main storage dam and the diversion dam would also be diverted.

The intake to the diversion tunnel would be located on the left abutment of the diversion dam. The selected 32,500-foot tunnel route would proceed through the left bank of Dinkey Creek. The unlined 10-foot diameter tunnel would be 24,000 feet long. A surge tank, also 21.5 feet in diameter and 263 feet high, would be excavated near the end of the tunnel. A transition section (about 4,000 feet) would connect the surge tank to a 6-foot diameter, 7,000 foot long steel penstock leading to Power Plant No. 2.

Power Plant No. 2 would also be a single-unit plant, rated at 63 mW. The plant would be of the conventional outdoor type, constructed of reinforced concrete. The switchyard, located adjacent to the powerhouse, would contain the necessary switching gear to handle the incoming 138-kilovolt transmission line. It would connect with the existing Pacific Gas and Electric Company (PG&E) transmission line located at the Kings River Power Plant.

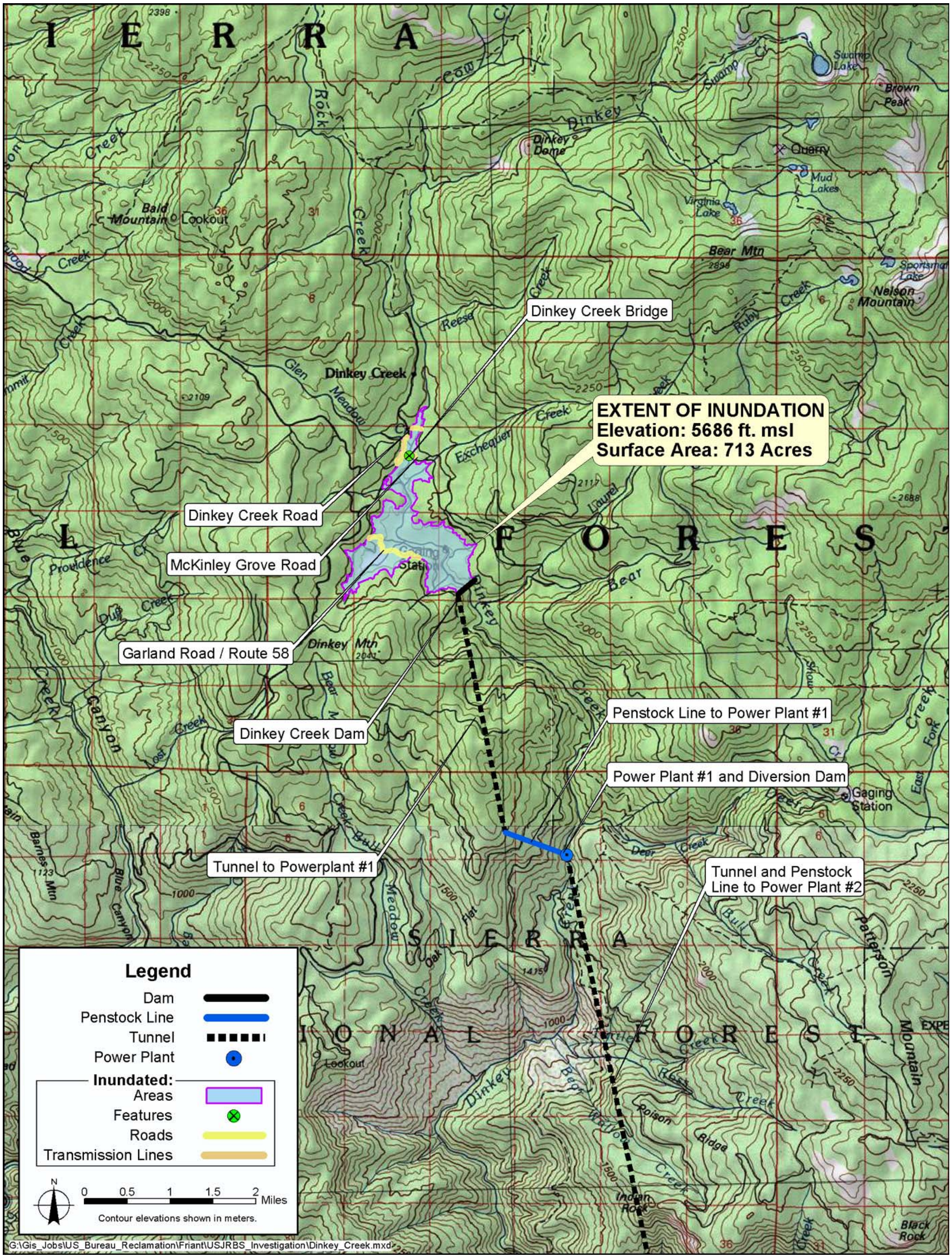

FIGURE 1-3. PROPOSED FEATURES AND POTENTIALLY INUNDATED AREA

APPROACH AND METHODOLOGY

This Technical Memorandum (TM) was prepared from a review of the prior study listed above, an engineering field reconnaissance on 13 June 2002 (Appendix A), and an environmental field reconnaissance of the dam and reservoir made on 29 May 2002 (Appendix B).

During the June 2002 field trip, engineers and geologists examined the site under consideration. Locations of existing and proposed structures were visually assessed. Topography, geology, geotechnical conditions, and utilities were noted. Access routes were considered, as well as possible borrow, staging, and laydown areas.

During the environmental field review, specialists in botany, wildlife, aquatic biology, recreational resources, and cultural resources visually assessed existing environmental resources. Additional research was conducted, making use of prior studies and available literature, the California Natural Diversity Database, topographic maps, and aerial photographs. This information was used to preliminarily identify the extent to which potential environmental impacts might constrain the storage options under consideration. Where evident, opportunities for improving environmental resources or mitigating adverse effects were also noted. Surveys and consultations with external resource management or environmental agencies were not conducted.

The seismotectonic evaluation conducted by Reclamation for this study was based on readily available information and is considered appropriate for appraisal-level designs only. Detailed, site-specific seismotectonic investigations have not been conducted for this preliminary analysis. Aerial/remotely-sensed imagery was not evaluated for this appraisal-level assessment. More detailed, site-specific studies will be required for higher-level designs.

For planning level studies, designs and analyses are typically quite general. Extensive efforts to optimize the design have not been carried out, and only limited Value Engineering (VE) techniques have been utilized.

CHAPTER 2. TOPOGRAPHIC SETTING

TOPOGRAPHY

Regional topography consists of the nearly level floor of the San Joaquin Valley rising abruptly to moderately steep, northwest-trending foothills with rounded canyons. Farther east, and in the area of the proposed damsite, the terrain steepens and the canyons become more incised. The canyons of the watershed have been cut by southwest- to west-flowing rivers and associated large tributaries. The Kings River is the main river in the area. The topography of the Kings River basin is the most rugged in the entire Sierra Nevada mountain range, rising to over elevation 14,000 in the upper watershed.

Elevations in the immediate area range from about elevation 5,360 in the streambed of the proposed dam site to over elevation 7,000 in the surrounding mountains. The proposed dam is located in a section of river that passes through a narrow, southeast trending bedrock canyon. The ground at the right abutment rises steeply from the riverbed, then flattens at a 3.5:1 horizontal to vertical slope until it encounters a ridge at an elevation of nearly 6,700 ft. Similarly, the left abutment slope rises steeply adjacent to the river, but flattens to an overall 5.5H:1V slope.

AVAILABLE TOPOGRAPHIC MAPPING

Topographic mapping of the study area from the U. S. Geological Survey (USGS) maps are publicly available. It is presumed that topographic maps of the dam and reservoir site are available from the KRCD at an unknown scale and contour interval.

AVAILABLE AERIAL PHOTOGRAPHY

Aerial photography of various scales and imagery is available from the archive files of the USGS. Additional aerial imagery may also be available from the U.S. Department of Agriculture, Reclamation, KRCD and U.S. Army Corps of Engineers. A specific search of the available photography was not conducted for this Technical Memorandum, nor was any preexisting aerial photography reviewed.

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CHAPTER 3. GEOLOGIC AND SEISMIC SETTING

REGIONAL GEOLOGY AND SEISMICITY

The Kings River basin is within a complex geologic area containing pre-Cretaceous meta-sedimentary and meta-volcanic rocks that have been folded, faulted, and intruded by granitic rocks of three different ages. Volcanism, followed by glaciation and recent stream down cutting, modified the topography to essentially the present day landscape. Major geologic structures trend to the northwest. Bedding and foliation of the rock units typically strike northerly and dip steeply west. Degree of weathering and jointing is variable, depending on rock type.

Overall, potential seismic hazard potential at the site is low. Preliminary earthquake loading parameters evaluated as part of this study considered two types of potential earthquake sources, fault sources and areal/background sources.

Twenty-two potential fault sources for the project site were identified. They included those associated with the San Andreas fault, seven western Great Valley faults, seven eastern Sierra Nevada faults, the White Wolf fault of the southern San Joaquin Valley, and six faults of the Sierra Nevada Foothills system. No major through-going or shear zones have been identified in this area of the Sierra Nevada and historic seismicity rates are low.

The areal/background seismic source considered was the South Sierran Source Block (SSSB), the region surrounding the project site. This region possesses relatively uniform seismotectonic characteristics.

Probabilistic seismic hazard analysis performed shows that the peak horizontal accelerations to be expected at the site are 0.13g with a 2,500-year return period, 0.18g with a 5,000-year return period, and 0.23g with a 10,000-year return period.

SITE GEOLOGY AND FAULTING

Mesozoic granitic bedrock underlies most of the region in the vicinity of the proposed Dinkey Creek damsite. Narrow aplite stringers and felsic dikes intrude the bedrock locally and scattered, small roof pedants of meta-sedimentary rocks are found within a mile of the site (IECO, 1974). In the nearby higher elevations, scattered deposits of glacial material cover much of the land surface

Dinkey Creek has cut a narrow gorge, nearly 150 feet deep in places. As such, the final damsite location could vary over a distance of a few hundred feet. Bedrock is covered in a few scattered locations by thin talus deposits and large blocks of loose rock.

No significant through-going faults are known to exist in the area of the site.

SITE GEOTECHNICAL CONDITIONS

According to the IECO 1974 report, and as observed during the filed reconnaissance, the steep lower portions of both dam abutments expose fresh, very hard granite that varies from slightly fractured to massive. Higher up the canyon walls, the rock is slightly weathered and somewhat more fractured, with exfoliation and stress relief fractures becoming more evident. Slightly fractured bedrock, locally obscured by talus and slope wash, is exposed over much of the reservoir area. No large existing or potential landslides have been identified, consequently only minor slumps from steeper slopes are expected upon reservoir filling.

In the left abutment, a three-dimensional joint pattern is evident. Most fractures appear to be tight. Higher up on the left abutment, a small gully filled with talus/slope wash traverses the center of the abutment. Downstream of the abutment, alluvium has accumulated near the confluence with Laurel Creek.

On the right abutment, there are a greater number of large, loose granitic blocks than on the left abutment. Near the downstream end of the rock mass, is a large (10’ x 20’ x 50’) block of loose, exfoliated granite and farther on is a steep ravine containing slope wash and talus. The proposed spillway is located on the right abutment. Excavation in this location will be in fresh, slightly fractured granite. Because a relatively deep cut is anticipated, rock bolting of the excavation should be anticipated.

Alluvial deposits occur within Dinky Meadow Creek and downstream of its confluence with Dinkey Creek. The creek channel is filled with large scattered boulders within the narrow gorge. Competent, hard granitic bedrock is expected to underlie the streambed. Potholes are found locally up to 10 feet in diameter.

The areas traversed by tunnels and appurtenant structures downstream of Dinkey Creek are composed essentially of granitic rock. On the whole, it is expected that the granitic rock will be relatively unweathered and only slightly fractured, and tunnel support is not expected to be necessary. However, there appear to be four different granitic rock types. Contact zones between these granitic plutons may be quite fractured and tunnel support may be required in such intervals. Furthermore, some meta-sedimentary and basic intrusive rocks are found in the area. Portions of the tunnels may penetrate these units, depending upon selection of the final alignment, and support may be required. Moderate water flow should be anticipated in the more closely fractured zones. Methane and toxic gases are not expected.

CHAPTER 4. HYDROLOGIC SETTING

DRAINAGE AREA

The Kings River watershed upstream of the proposed Dinkey Creek Dam covers approximately 51 square miles, ranging over elevations from about elevation 5600 at the proposed dam site, to elevation 14,000.

RAINFALL

Rainfall in this Mediterranean climate region varies from about 8 or 9 inches per year in the Central Valley to about 60 inches per year in the Sierra Nevada. About 90 percent of runoff-producing precipitation occurs during the months of November through April.

Precipitation usually occurs as rain at elevations below 4,000 feet and as snow at higher elevations. However, snow has occurred in the San Joaquin Valley, and rain sometimes occurs at elevations above 10,000 feet. The snow pack accumulates during the winter and early spring and generally starts melting in April.

EROSION, RUNOFF, AND RECHARGE

Specific erosion potential information for the site was not identified. However, some information on soils is available. IECO reported in 1974 that the upland soils of intermediate elevations in the Sierra Nevada, where developed, are moderately deep to deep, medium to moderately fine-textured, medium to strongly acidic, and based on basic igneous and meta-sedimentary rocks.

Discharge records are available for water years 1922 to 1935 for Dinkey Creek at Dinkey Meadow. Gage No. 2170 is located just upstream of the proposed Dinkey Creek Dam. Average annual flow at Dinkey Creek is 104 cfs, with a maximum average flow of 315 cfs, and a minimum annual average of 26 cfs (IECO, 1974).

AVAILABLE FLOOD DATA

Detailed flood data were not identified in the documents reviewed.

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CHAPTER 5. ENVIRONMENTAL SETTING

INTRODUCTION

This chapter describes existing environmental resources at the site and qualitatively describes potential effects of the proposed surface storage option, indicating the extent to which expected or potential environmental effects might pose a constraint to its development. Where evident, opportunities for improving environmental resources or mitigating adverse effects have been noted. The analysis concentrates on botany, terrestrial wildlife, aquatic biology, recreational resources, cultural resources, and existing land uses. Mining and other known past activities that might affect site conditions are also briefly discussed, along with the potential presence of hazardous or toxic materials. Temporary construction related disruptions and impacts are discussed in Chapter 6.

The identification of constraints was conducted at a preliminary, appraisal level of planning, consistent with the current phase of the Investigation. Criteria considered were based, in part, upon criteria commonly used to evaluate environmental impacts of projects under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The application of criteria that may be used for NEPA or CEQA evaluation does not imply that the analysis is at a level that would be needed for an Environmental Impact Statement or Environmental Impact Report. Considerations included: presence of special status species (e.g. Federally listed endangered species), species of concern, or sensitive habitats; relative amounts of affected riparian or wetland habitat; effects on native or game fish; conflict with established recreational uses or land uses; presence of nationally registered historic places, sacred Native American sites, or traditional cultural properties; permanent disruption or division of established communities; and any loss of energy production facilities.

The environmental setting descriptions provided in this chapter pertain principally to the potential inundation area of the main proposed dam on Dinkey Creek.

BOTANY

Overview of Existing Conditions

The primary habitat is mixed Sierran forest (yellow pine forest). Meadows and riparian habitats have also been identified in the area. Chaparral and oak woodland occur in areas affected by roads and spoil sites. Giant sequoia groves are located in areas that could be affected by the diversion tunnel. The soils and geologic conditions are granitic.

Two special-status species are known to occur in the area, orange lupine and tree-anemone. Only the tree-anemone is listed. None of the locations identified in the California Natural Diversity Data Base (CNDDB) as sites where it occurs are in the immediate proximity of the potential dam and reservoir, but there is abundant suitable habitat for this species present. Populations of *Carex whitneyi* and *Pityopus californicus* have been reported from the area affected by the potential reservoir. *Carex whitneyi* is no longer considered a special-status species and *Pityopus californicus* is a California Native Plant Society (CNPS) List 4 species.

Constraints

The loss of wetlands and riparian habitat would be the primary constraint. Loss of mixed Sierran forest would affect timber harvest in the area. New locations of the tree-anemone that would be affected by construction of the reservoir, roads, and other facilities would be an additional constraint. A 1980 Environmental Impact Statement indicated that the diversion tunnel could affect giant sequoias in the McKinley Grove. This would be considered a serious adverse impact.

Opportunities

Several state and federal agencies have been apparently assessing measures to mitigate impacts from this proposed storage option. It is unclear whether mitigation could occur within the Dinkey Creek watershed.

WILDLIFE

Overview of Existing Conditions

The Dinkey Creek area hosts a relatively diverse wildlife community with an abundance of deer, bear, and mountain quail. While the area has only limited development, few sensitive wildlife species are recorded for the area. The Mt. Lyle salamander has been recorded, as well as the willow flycatcher. The salamander is not federally or state listed as threatened or endangered. The willow flycatcher has been recorded within a few miles of Dinkey Creek. However, the area does not appear to currently support the riparian woodlands this species requires for nesting.

Constraints

A reservoir in this relatively remote area would considerably alter the biological setting. The damming of a free flowing mountain stream would likely be a concern to resource agencies. Development of this measure would appear to destroy habitat for the threatened willow flycatcher; this would be an important constraint if the flycatcher is still presently inhabiting and nesting in the area.

AQUATIC BIOLOGY/WATER QUALITY

Overview of Existing Conditions

Although remote, Dinkey Creek is a popular recreation area and trout fishing destination. A number of campgrounds and residences are located near the stream.

Dinkey Creek is a major tributary of the North Fork Kings River. Flow at the potential dam site typically varies from about 5 cfs in late summer and fall to about 500 cfs in April through June. In wet years, May and June flows often exceed 1,000 cfs. The creek is a high gradient stream with a bedrock-controlled channel, with some alluvial sections as well.

The Dinkey Creek elevation places it in the Rainbow Trout Fish Zone. Rainbow trout and brown trout are currently the principal species in the stream.

Constraints

The reservoir of a 340-foot dam would inundate a little less than 3 miles of the stream. Principal effects on aquatic biological resources result from replacement of stream habitat with lacustrine habitat and altering the instream flow regime downstream of the potential reservoir. Populations of fish and other organisms adapted to a stream environment could be reduced or eliminated from inundated areas, while those of species adapted to lacustrine conditions would be enhanced. Trout are well adapted to both types of environments and would probably survive well in the new reservoir.

Storage and releases from the new reservoir would alter the timing of flows in Dinkey Creek, and diversions would reduce flow. The proposal for a Dinkey Creek Project with a 340-foot dam includes diversions that would reduce average flows from December through June to as little as one tenth of pre-project levels. This reduction in flow, particularly during spring and summer, when rainbow trout are spawning and the young are growing, could affect physical habitat availability. Adult trout generally require much higher flow velocities than juvenile trout, so reduction in flows could impair production of older trout but benefit younger life stages. Physical habitat analysis (e.g., PHABSIM) would be needed to determine the net effect of changes in flow.

The reservoir created by damming Dinkey Creek would likely stratify during summer months. Therefore, assuming water was released from the lower reservoir depths (hypolimnion), the reservoir would result in colder water temperatures below the discharge point. Trout require relatively cold water, but at the elevation of Dinkey Creek, unimpaired water temperatures are generally ideal. Water released from the reservoir would likely be so cold as to reduce growth and development of the trout, and thus inhibit production. However, because of reduction in flow, summer water temperatures in Dinkey Creek would rapidly warm with distance downstream from the dam and could therefore exceed temperatures required by trout further upstream than under pre-project conditions. Water temperature modeling (i.e., SNTEMP) would be required to resolve this issue. Water diverted from the new Dinkey Creek Reservoir, particularly if conveyed in tunnels and sheltered from the sun, would remain cold for a considerable distance and would likely cool the water temperatures of its receiving stream or reservoir.

Resident stream rainbow trout seasonally migrate to varying degrees and construction of Dinkey Creek Dam would impose a barrier to trout migrations. The significance of trout migrations in streams is poorly understood, but they may be important, particularly for spawning.

Entrainment of fish into diversion structures and powerhouses could result in substantial mortality. However, this mortality would likely be offset by increased fish production due to new fish habitat created by the reservoir.

Opportunities

The principal opportunity afforded by this measure is the substantial new fish habitat created by the reservoir. This reservoir would provide excellent conditions for a trout fishery. Rainbow and or brown trout populations would probably be successfully self-sustaining, but regular stocking could increase production.

If existing vegetation in the new Dinkey Creek Reservoir inundation area were not removed prior to building the new dam, it would be inundated, providing a short-term increase in nutrient levels in the reservoir and enhancing habitat structure. Both effects would likely benefit fish production.

Providing adequate minimum instream flow releases from Dinkey Creek Reservoir would help protect fish populations downstream. An instream flow study would be needed to determine suitable flow levels for releases.

RECREATION

Overview of Existing Conditions

This new dam site and reservoir would be situated mainly on public lands of the Sierra National Forest, managed by the U.S. Forest Service. The Dinkey Creek area provides a variety of recreation opportunities, based mainly around Dinkey Creek. The community of Dinkey Creek, the Trails End Resort, and Dinkey Creek Inn, located just upstream of the proposed inundation area, provide lodging and other recreation oriented services.

The area that would be inundated is relatively developed and includes two organization camps (Camp Mary-Y-Mac and Camp El-O-Win), recreation residences, and paved and unpaved access roads. In the area surrounding the proposed inundation pool, there is another organization camp (Fresno Junior), a public cabin complex (Camp Fresno), numerous recreation residences, developed campgrounds, picnic areas, trails, and parking areas.

Constraints

Constructing a dam and creating a reservoir on Dinkey Creek would inundate two organization camps, several recreation residences, and paved and unpaved access roads. Loss of these developed facilities and the opportunities and activities they support would be considered substantial adverse impacts. These facilities would have to be reconstructed elsewhere to avoid displacing recreation visitors, along with suitable access routes.

Over the long term, Dinkey Creek Reservoir would probably provide as many or more recreation opportunities as are currently present. The reservoir would provide a large body of water that would provide increased opportunities for fishing, swimming, and boating. River oriented recreation activities would continue to be present along Dinkey Creek upstream and downstream of the reservoir. Increased use at the reservoir would create demand for new facilities that should be considered part of the project.

Outlying organization camps, campgrounds, picnic areas, nearby towns, and commercial developments would probably benefit from a reservoir over the long term. However, these would be adversely affected by noise, dust, and air pollution during the construction period.

Mitigation measures should be included to abate dust, noise and air pollution to the extent possible. Overall recreation use in the area would probably decrease during the construction period, so commercial businesses that depend on recreation income may have to be compensated.

Opportunities

PG&E considered the possibility of constructing a similar reservoir for hydropower. As part of their studies, they conducted recreation visitor surveys to evaluate appropriate types of recreation improvements. According to PG&E, the survey respondents indicated an overwhelming desire to limit development that might otherwise detract from the existing recreation environment. Respondents also indicated that: 1) a commercial complex like Dinkey Inn should be retained; 2) power boating on the reservoir should be limited or restricted; and 3) project recreation development should be limited to low density level. A similar survey should be undertaken to determine whether these views have changed.

CULTURAL RESOURCES

Overview of Existing Conditions

The lower reaches of Dinkey Creek were traditional territory of the Wobonuch people, Numic-speaking relatives of the Northfork Mono along the San Joaquin River. The Wobonuch lived in small settlements along larger watercourses. It is likely that Wobonuch people traveled to the headwaters of Dinkey Creek for summer fishing and deer hunting, and for traveling across the Sierra Nevada via Piute Pass.

The Dinkey Creek area has been surveyed for cultural resources in connection with a proposed reservoir development by KRCD. In 1981, testing of eighteen potentially impacted sites in the area demonstrated substantial occupation of the area as early as BC 4000.

Specific information is presently unavailable regarding the history of the Dinkey Creek area. A variety of sites are likely to be present, associated with mining, logging, grazing, recreation, and other activities. In 1863, hunters reportedly named the creek for their dog Dinkey who was injured in a fight with a grizzly bear. In 1878, John Muir mentioned the presence of a grove of giant sequoias named Dinkey Grove on Dinkey Creek.

Constraints

Numerous cultural resources are known to be present. Inundation of archaeological sites (prehistoric or historic) can result in loss of important scientific data. As many as 18 or more archaeological sites could be adversely affected by construction of Dinkey Creek Dam. Smaller dam configurations would presumably inundate fewer sites.

Some sites tested by Kipps were recommended as eligible for the National Register of Historic Places, but specific information regarding their status is not presently available and it is likely that the sites would require re-evaluation under an updated research design. No Native American sacred sites or Traditional Cultural Properties (TCPs) are known to occur, but Wobonuch Mono concerns are expected.

Opportunities

Inundation damage to archaeological sites can be mitigated with scientific data recovery programs. Reservoir projects also provide an opportunity for public interpretation of the past. Ancillary project facilities, such as roads, power lines, or other structures, may avoid impacts to archaeological sites through design or facility placement.

LAND USE

Overview of Existing Conditions

Ranchettes and other private homes are abundant in this popular recreation area. Private residences and roads, public lands, and timber reserves may be located in the areas of inundation (Figure 1-3). Major facilities that would be inundated below elevation 5,686 include the following:

- McKinley Grove Road;
- Dinkey Creek Road;
- Connecting road crossing Dinkey Creek Bridge and Garland Road; and
- Route 58.

Constraints

Dinkey Creek represents a well-developed recreation-based community with many residences located in this area because of the proximity to recreation opportunities. This interrelationship between recreational and residential uses is well described in the recreation section. This measure would have significant land use constraints because of its impact on an existing vital community.

Opportunities

No land use opportunities have been identified for this measure. Mitigation of impacts to the existing recreation based community would be difficult.

MINING AND OTHER PAST ACTIVITIES

Overview of Existing Conditions

The community of Dinkey Creek is located in the central Sierra Nevada, away from tectonic structures that typically create concentrations of valuable minerals and lacking in large alluvial deposits suitable as aggregate.

As evidenced in USGS topographic maps, a sawmill once existed, above the proposed inundation line, in the Dinkey Creek community (west of the Ranger Station) indicating that logging in the area was once conducted. The USGS maps also show a prospect, or mining claim, on the right bank of Dinkey Creek, just upstream of the proposed dam. There is no indication that the prospect is, or ever was, active.

Constraints

Since the sawmill appears to be closed and removed and the prospect does not appear significant, there are no constraints identified.

HAZARDOUS AND TOXIC MATERIALS

Overview of Existing Conditions

The community of Dinkey Creek may possess, or may have once contained underground or aboveground petroleum hydrocarbon storage tanks. The sawmill may have used underground fuel and lubricant storage tanks, or electrical transformers containing polychlorinated biphenyls (PCBs). While, the mineral(s) of interest at the mining prospect is not known, fuel, lubricants, or extraction chemicals might have been used at the site.

Constraints

While the former sawmill appears to have been demolished and removed, potential impacts to the site from fuel and lubricant hydrocarbons and from electrical transformers may exist on the site. If so, they would require remediation. Similarly, although the prospect shows no significant evidence of activity, mining associated chemicals could be present.

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CHAPTER 6. POTENTIAL DAM STORAGE STRUCTURES AND APPURTENANT FEATURES

EMBANKMENTS

In their 1974 study, IECO adoped a zoned embankment design as being the most suitable for the site, since impervious fill material is available locally. However, future studies could also consider Roller Compacted Concrete (RCC), gravity, or Concrete Faced Rockfill Dam (CFRD) designs.

The IECO study established the main dam crest at elevation 5,700, resulting in a dam height of approximately 340 feet above the riverbed. At this elevation, the crest length would be about 1,600 feet, and the gross pool elevation would be about elevation 5,686 feet. The crest width would be approximately 20 feet.

The zoned rockfill embankment as conceived by IECO in their study, would consist of an impervious core, flanked upstream and downstream by filters, transition zones of disintegrated granitic rock from required excavations, and rockfill shells on both the upstream and downstream sides. A filter blanket and a chimney drain of coarse material would be provided downstream of the impervious core. The upstream face of the dam would slope at 1.85:1 (horizontal to vertical) and 1.75H:1V on the downstream side. Figure 6-1 is a cross section from the 1974 IECO study.

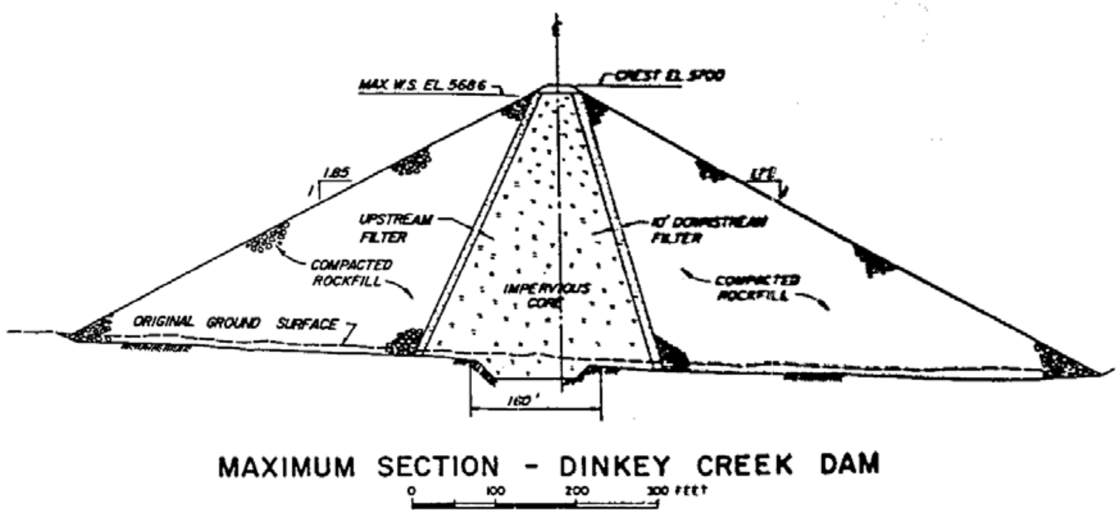

FIGURE 6-1. CROSS SECTION OF THE ROCKFILL EMBANKMENT

RESERVOIR CAPACITY CURVE

A reservoir storage volume versus elevation curve is shown in Figure 6-2. The data used to generate the curve are taken from the 1974 IECO report.

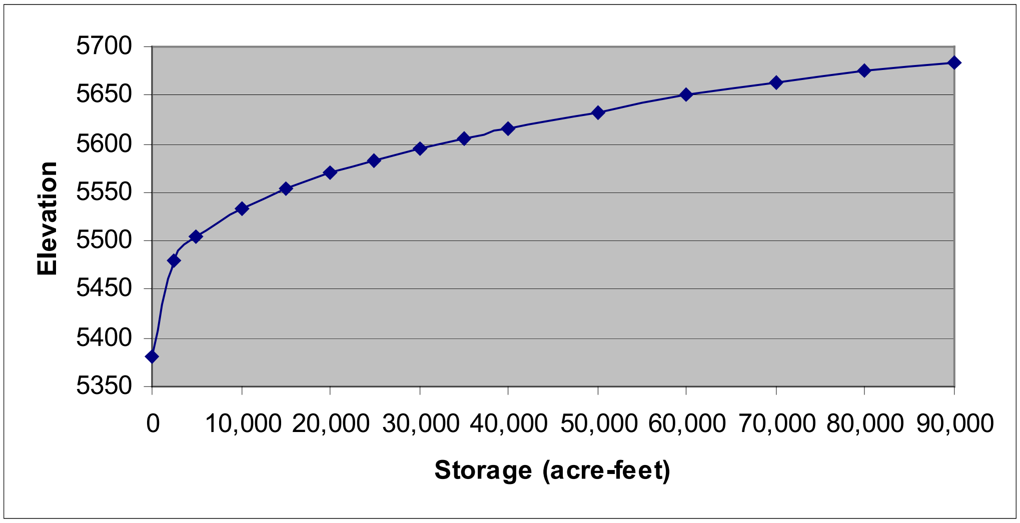

FIGURE 6-2. RESERVOIR AREA VS. STORAGE RELATIONSHIP

CONSTRUCTABILITY

Land, Right-of Way, Access, and Easements

Paved county roads pass within 1 mile of the proposed dam axis. Access to the dam site is afforded on both the right and left abutments by graded roads passable in 4-wheel drive vehicles.

Borrow Sources/Materials

IECO did not carry out a formal construction materials investigation, but potential borrow deposits were noted in their report. Deposits of impervious materials, containing a high percentage of fines, were not noted in the vicinity of the dam site, however, the report recommended exploration of some of the nearby, relatively flat meadow areas that might contain such suitable material.

Pervious materials could be obtained from alluvial deposits occurring along Dinkey Creek about one mile upstream of the proposed dam site. Pervious materials were also reported to occur along Dinkey Meadow Creek. Exploration and testing would be necessary to evaluate the extent and suitability of such materials.

Decomposed granite suitable for use in transition zones between the filters and rockfill zones would likely be generated from required excavations for the dam and spillway. Ample quantities of hard, granitic rock suitable for quarrying of riprap, rockfill, and concrete aggregate is exposed near the proposed dam site.

Foundations

The dam would be founded on hard granite. A core trench would be excavated a minimum of 5 feet into the rock under the impervious core, after stripping of approximately 10 feet of highly weathered surface material.

Power Sources

There is power in the Dinkey Creek area that could be accessed.

Staging and Lay Down Area

A contractor staging and laydown area is available in Dinkey Meadow where the canyon widens 1.5 miles upstream of the proposed dam site.

Contractor Availability and Resources

There are several regional general contractors capable of performing the work necessary to construct the dam.

Construction Schedule and Seasonal Constraints

At the site elevation, construction would more than likely have to be interrupted during winter. Therefore, the main dam would probably be built over a period of three years. This assumes that excavation of the diversion tunnel could be conducted during the first spring and summer, with river diversion in mid-Summer. Excavation and foundation treatment would follow in late summer and fall. Placement of the dam embankment would begin in the spring of the second construction season, and would be topped out in the third construction season

Flood Routing During Construction

The diversion works would consist of an upstream cofferdam, a temporary downstream cofferdam, and a 1,000-foot long, 10-foot diameter horseshoe-shaped diversion tunnel, that would pass through the ridge of the left abutment. The upstream cofferdam would be incorporated into the main dam.

Environmental Impacts During Construction

Environmental impacts during construction could be mitigated with proper planning and implementation of best management practices. Noise and visual impacts will be significant to the inhabitants of Dinkey Creek. Air quality issues can be mitigated by dust control measures for quarry, material processing, and construction on the dam. Blasting that will be required for abutment excavation, and quarries will require both noise and vibration monitoring on the dam. A cultural survey will have to be conducted to identify any ancestral

American Indian or historic artifacts and construction activities would be restricted in those areas. Importing cement and concrete aggregate from distant plants may cause traffic impacts but with proper planning and coordination with Caltrans, the major impacts could be mitigated. All construction equipment should have spark arresters and fire control equipment should be kept readily accessible during construction. Construction water would have to be controlled as well as provisions made for runoff and erosion control. A spoil control plan would be needed to control any construction-related fuels, lubricants, and other materials.

Permits

Both federal and non-federal entities would sponsor construction of the dam. This joint sponsorship complicates the permitting process somewhat as federal projects are not subjected to the same level of permitting that are required for non-federal projects.

Given the probable duality of sponsorship, and potential environmental and cultural impacts identified, at a minimum, the following permits and permitting agencies may become involved:

Permit	Permitting Agency
Permit to Construct	FERC, DSOD, Fresno County
Encroachment	Caltrans, Fresno County
Air Quality	CARB, Fresno County
Low/No Threat NPDES	RWQCB
Waste Discharge	RWQCB
401 Certification	SWRCB
Blasting	Fresno County
Stream Bed Alteration	CDFG
Fire/Burn	CDF, Fresno County

In addition, the following agencies could be involved in the review of permit conditions:

Bureau of Land Management;

State Historic Preservation Office;

Advisory Council on Historic Preservation; and

U.S. Fish and Wildlife Service.

In obtaining these various permits, several plans would have to be prepared, submitted to the responsible agencies for review and approval. Some of these include:

Construction Plan and Summary Documents;

Quality Control Inspection Plan;

Highway Notification Plan;

Blasting Plan;

Noise Monitoring Plan;

Water Quality Monitoring Plan;

Noxious Weed Control Plan;

Bat Protection Plan;

Management Plan for Avoidance and Protection of Historic and Cultural Properties;

Storm Water Pollution Prevention Plan;

Spill Prevention/Containment Plan;

Visual Quality Control Plan; and

Dust Control and Air Quality Plan.

Another important regulatory requirement involves compensation /mitigation for habitat loss. In October 1998, the U.S. Fish and Wildlife Service (FWS) issued their draft Coordination Act Report and Habitat Evaluation Procedure (HEP Analysis). The HEP Analysis delineates how compensation for adversely affected baseline habitat and wildlife conditions is to be determined.

In addition, if power generation is included in a project or is modified for an existing project, the Federal Energy Regulatory Commission (FERC) may become involved in the permitting process.

APPURTENANT FEATURES

Conveyance

The intake structure at the main dam would lead to an unlined, 17,000-foot long, 10-foot diameter tunnel (slope at 0.008), emptying into a surge tank excavated in bedrock. The concrete lined surge tank would have an inside diameter of about 21.5 feet and height of 263 feet. An 8-foot diameter steel lined tunnel would lead for about 2000 ft from the surge tank to a 6-foot diameter steel penstock, 2000 ft in length, connecting to Power Plant No. 1.

A 30-foot-high concrete diversion dam, located approximately 4 miles downstream from the main dam, would divert the discharge from Power Plant No. 1 into another tunnel, which would extend to Power Plant No. 2. The diversion capacity would be more than 350 cfs. Intervening flow from the drainage area between the main storage dam and the diversion dam would also be diverted.

The intake to the 10-foot diameter, unlined tunnel would be located on the left abutment of the diversion dam. This tunnel would be 24,000 feet long and have a slope of 0.008. The selected 32,500-foot tunnel route would proceed through the left bank of Dinkey Creek. A surge tank, 21.5 feet in diameter and 263 feet high, would be excavated near the end of the tunnel. A transition section (about 4,000 feet) would connect the surge tank to a 6-foot diameter, 7,000 foot long steel penstock leading to Power Plant No. 2.

Pumping Plants

Water would be conveyed by gravity; therefore, no pumping plants would be required.

COSTS

Initial Construction Costs

Based on the 1974 IECO Cost Estimate, the cost estimate for the proposed Dinkey Creek Dam hydropower project was updated to April 2002 unit costs using Reclamation Construction Cost Trends. Costs were also evaluated by MWH dam cost estimators and costs were modified to reflect current material costs and standards of practice especially with respect to seismic requirements. Costs for the storage only project were estimated by subtracting the estimated costs for the power generation portions from the original estimate.

Hydropower Project - The estimated total construction cost for the proposed Dinkey Creek hydropower project is approximately $423 million.

Storage Only Project - The estimated total construction cost for a storage only project at Dinkey Creek is approximately $122 million.

Estimated cost components are presented below in Table 6-1 and in Appendix C. Field costs represent the estimated cost to construct identified features, plus provisions for unlisted items (15 percent), contingencies (25 percent), and mitigation (5 percent). Land costs are excluded from this appraisal-level estimate. Additional study of land requirements would be needed to determine their cost. Total project costs include field costs plus estimated costs for future analyses and planning documentation, development of designs, and construction management (15 percent).

TABLE 6-1
SUMMARY OF PROJECT FIRST COSTS

Dinkey Creek Dam and Reservoir	**Estimated Cost ($Millions)**	
Cost Component	**Hydropower**	**No Hydropower**
Main Dam	68.4	68.4
Spillway	2.3	2.3
Diversion Dam	1.5	
Power Intake, Tunnels, Penstocks	155.5	
Powerplants and Generating Equipment	11.5	
Transmission Facilities	4.2	
Unlisted Items	36.5	10.6
Contingency	70	20
Mitigation	18	5
Total Field Cost	368	106
Investigation/Design/CM	55	16
Total Project First Cost	423	122

Operations and Maintenance Costs

Operations and maintenance (O&M) costs were not evaluated in any of the previous studies of the proposed Dinkey Creek project and were not estimated for this report.

SYSTEMS OPERATIONS

Water stored in Dinkey Creek Reservoir would be released to Dinkey Creek, which would then contribute to flow in the North Fork of the Kings River. Releases from Dinkey Creek Reservoir would be exchanged for water diverted from Millerton Lake or offset Millerton releases to the San Joaquin River.

Hydropower aspects of the project are addressed in Chapter 7.

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CHAPTER 7. HYDROELECTRIC POWER OPTIONS

PUMPED STORAGE CONSIDERATIONS

The proposed Dinkey Creek project would not result in a pumped storage option.

ADDED HYDROELECTRIC POWER TO EXISTING STRUCTURES

There are currently no hydroelectric facilities at the site.

NEW HYDROELECTRIC POWER

The Dinkey Creek project has the potential to generate up to 89 mW of firm hydroelectric energy, by developing 4,400 feet of head between Dinkey Meadow and the confluence of Dinkey Creek and the North Fork of the Kings River.

Power Plant No. 1 would be a single unit, 26 mW plant. Power Plant No. 2 would also be a single-unit plant, rated at 63 mW. The vertical-shaft, impulse-type turbine at Plant No. 2 would be rated at 94,000 horsepower (hp) at a net head of 3,055 feet.

Table 7-1 summarizes results of the reservoir operation and power studies (IECO, 1974). It was assumed that intervening flow between the storage dam and the diversion dam would provide additional water for power generation at Power Plant No. 2. It also assumed that the project would operate at a Plant Factor (PF) of 0.25; i.e., for 6 hours per day only 25 percent of the intervening flow would be diverted. Average annual energy production is estimated at 72,110,000 kilowatt-hours (kWh) for Power Plant No. 1 and 200,100,000 kWh for Power Plant No. 2, for a total of 272,210,000 kWh (IECO, 1974).

TABLE 7-1
ESTIMATED ENERGY PRODUCTION

	Dinkey Storage Dam & Power Plat No. 1	Dinkey Diversion Dam & Power Plant No. 2
Full Reservoir Capacity (AF)	90,000	5
Full Reservoir Elevation (ft)	5,686	4,400
Minimum Reservoir Capacity (AF)	0	0
Minimum Reservoir Elevation (ft)	5,380	4,370
Installed Capacity (mW)	26	63
Average Annual Turbine Discharge (cfs)	101	117
Maximum Gross Head (ft)	1,286	3,120
Firm Power/0.25 PF (mW)	25.4	62.5
Average Annual Energy (kWh)	72,110,000	200,100,000

TRANSMISSION AND DISTRIBUTION

It is expected that transmission lines from the two powerhouses would tie into the existing 138 kilovolt line at the PG&E Balch Camp powerhouse.

The switchyard, located adjacent to the powerhouse, would contain the necessary switching gear to handle the incoming 138-kV transmission line. It would connect with the existing Pacific Gas and Electric Company (PG&E) transmission line located at the Kings River Power Plant.

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